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VOLUME 301 112th YEAR LONDON MARCH 9, 1960 No. 5036 PRICE 1/6d.

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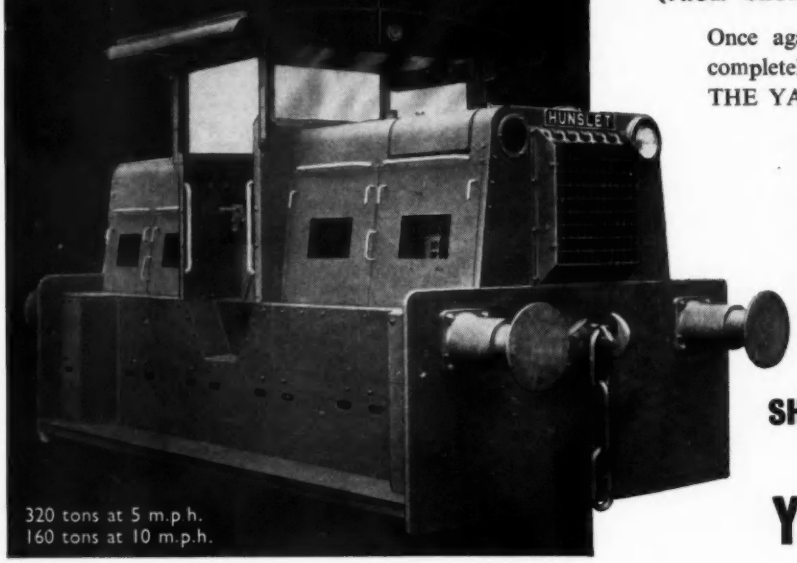

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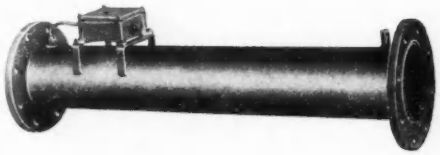

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Gas Journal

COKE OVENS • BY-PRODUCTS • CHEMICALS

An energy pattern in Europe?

THE changes in fuel demands in Great Britain in the last two years have also had their counterpart in Continental Europe. The situation there, as here, has changed from a state of chronic shortage to one of keen competition between alternative fuels.

In 1956, the Council of O.E.E.C. set up an Energy Advisory Commission under the chairmanship of Professor Austin Robinson, of Cambridge, to keep energy problems under constant review. The members of the Commission were to act as independent experts to the Organisation and not as official representatives of their respective countries.

The Commission has recently published its report, ' Towards a New Energy Pattern in Europe,' in which it reassesses the prospective energy requirements and supplies to Western Europe.

Perhaps one of the most interesting points made early in the report is a reference to the changes that have taken place since a previous report, ' Europe's Growing Needs of Energy. How are they to be met? ', published by the Hartley Commission, under the Chairmanship of Sir Harold Hartley in 1955.

The most important changes seem to have been brought about by the discovery of new sources of oil and natural gas in Europe, the Sahara and elsewhere, and the effect these have had on the demand for coal. The change from a sellers' market to a highly competitive buyers' market cannot be put down entirely to the increased choice of fuels, but also, to some extent, to the recent recession.

Concerned as it is with the present state of the energy markets on the Continent, the Commission is also trying to look beyond the present and immediate future in order to give a longer-term assessment of energy needs. To do so and to avoid inaccurate forecasting, it has used three independent means, each of which has been found to give fairly similar results.

In spite of the recent recession, it is still confident that future energy requirements will be greater than what they were before the war and that it is quite realistic to take steps now to increase available supplies in the next 15 to 20 years.

An increase in indigenous sources is forecast as being 25% to 30% in the ten years 1955 to 1965 and an increase of 58% to 83% in the 20 years 1955 to 1975. To estimate the amount of fuel to be imported is rather more difficult, since the Commission is unwilling to say that the imports will merely be the extra fuel needed over and above that from indigenous sources. This is a particularly good point to make, since any such assumption makes no allowance for the suitability or otherwise of the fuels already to hand. However, the Commission suggests that imports, only 6% in 1938 and, 20 years later, 30%, will probably amount to about 32% in 1965, ranging between 28% and 36%; for 1975 the estimate is about 39%, ranging between 33% and 45%. In terms of actual tonnages, calculated as coal equivalent, the mean estimates of the total fuel consumption are, in 1965, 1,010 mill. tons and in 1975 1,325 mill. tons respectively.

The competitive position of coal in relation to other available fuels is clearly of interest and the report shows how coal prices have risen in both Europe and America between 1913 and 1956 by some 50% over all other prices. In Europe prices have continued to rise, while in America they have begun to fall. Crude oil prices, however, over the same period have closely followed the average of other wholesale prices. The inference to be drawn is therefore that coal is no longer competitive, in spite of an increased efficiency in burning it.

By 1975 the demand for natural gas is likely to be something between 50 and 135 mill. tons coal equivalent and nuclear power something above 30 mill. tons. If the lower figure for natural gas is taken, a coal demand of about 500 mill. tons would be expected. This last figure seems rather improbable until the price of coal has become far more competitive. The whole future use of coal would seem to depend on its use as a fuel for power stations or a raw material for gas or coke making.

The consumption of electricity is rising throughout Europe and the forecast is that the figure of 338,000 kWh. consumed in 1955 will have risen to 700,000 mill. kWh. by 1965 and to 1.2 bill. kWh. in 1975.

Lignite is being used in ever increasing quantities for power house boilers, so there is good reason to suppose that its production will be developed. It is not quite clear whether lignite is included in the coal estimates but we are of the opinion that it is.

Other sources of power are hydro-electric plants, oil, natural gas and nuclear power, all of which the Commission has considered separately.

What are the conclusions to be drawn from the report? Broadly speaking, it seems to us that they fall into what is by now a somewhat familiar pattern. The shortage of energy which appeared to be so serious as little as four years ago, need no longer cause any anxiety. Indigenous fuel is available and there seems no difficulty about fuel from abroad. The report stresses that all sources of energy must be exploited and nothing should prevent the use of the most economic fuel, and at present that fuel does not seem to be coal. This means that the best hope for the future of coal is as a raw material for carbonisation or as a fuel for power stations, but the Commission suggests finding new markets for coal products and natural gas in less well developed member countries.

Finally—and here we feel is the most constructive suggestion—the Commission recommend a much closer physical integration of energy in Western Europe.

Improving communications

A PAPER on telecommunications (see p. 394) might seem a little out of place in the 'GAS JOURNAL' and more at home in some technical publication on radio telephony. But a paper on the subject by Mr. G. M. Rimmer, Electrical and Mechanical Engineer of the West Midlands Gas Board, does come at a time when the gas industry is being compelled to use the most up to date aids for improving its communications over increasingly wide areas without having to take on extra personnel.

The use of telecommunications is rapidly developing in the nationalised industries and it may be roughly divided between transport and control. In the world of transport, we understand that the railways are exploiting modern means of communication for signalling as well as carrying information about the make-up trains, but in a smaller way the fuel industries, too, are developing their own particular transport applications.

The sales and service departments of several gas boards have used radio for some time for communicating with vans in which service personnel are travelling to specified work in some part of an urban area. Emergency calls received at a local service headquarters can be radioed to a fitter in one such van, known to be in a certain district; he can be diverted to the emergency point with the minimum of time lost.

This method of communication is clearly a logical development of the functionalisation of the executive section of the sales and service department, by which a fitter, who has finished a job at a specific point can be directed to another job with the minimum loss of time.

It will not be necessary for him to return to his workshop nor will he have to find a telephone call-box to report his availability.

Such a use for radio-communications is probably familiar to many in the gas industry and even to the general public, but the carrying of information and remote control over increasing distances has perhaps grown up so imperceptably since nationalisation that gas engineers may have come to regard it almost as a commonplace.

The building of grid systems and the concentration of gas manufacture has, as is well known, made it necessary to establish centralised control points for distribution, which in turn have needed the telemetering of stocks from holder stations and district pressures; remote control of valves and compressors has followed and unmanned storage points have been the logical consequence.

Up till now the distances involved have been but a few miles and a pair of telephone wires, rented from the Post Office, have provided the necessary electrical connection by which information has passed.

Developments now taking place point to grid systems becoming interconnected within a board's area and controlled from one or two central positions. Distances will increase and the need for more telemetering channels for the extra information to be carried, will become acute. As the distances covered increase, the rental of telephone lines becomes uneconomic, apart from the lines being unable to carry the added loads. If this situation is being reached in board areas, what will it be if a national grid ever becomes a reality? Telemetering between boards will be necessary and the routeing of gas to points remote from colliery gasification plants will have to be faced; so too will the starting-up of peak load plant at places at the far end of supply mains.

Radio in some form appears to be the solution to these problems, but like any other innovation, its use must be approached with caution. Short wave radio, V.H.F. and micro-wave systems will probably all have their part to play, but since installation is expensive, the best and most suitable system must be chosen for its proper place.

What has Mr. Rimmer's paper got to do with all this? Is it a guide for gas engineers in the choice of a system or is it a dissertation on an existing installation in Birmingham? It is neither. Mr. Rimmer has gone to particular pains to present to his fellow members of the Midland Section of the Institution, a clear and concise account of how telecommunications are likely to interest the gas industry and the underlying principles on which their use depends. He has gone into considerable detail to describe the limitations of the ordinary telephone line and has introduced us to some new jargon, which unlike some technological means of communication, does not consist of long words. Such homely words as, 'cross-talk' 'noise' and a 'bit' of information, though familiar, must of course be taken in their special contexts, and when they are, their meanings are immediately clear.

Such a lucid exposition of such a very complicated subject is most timely and will go a long way to enlighten the minds of many who may find themselves drawn into the invisible net of the extended grid communications of the future.

Mr. Rimmer points to the more extended use of radio by the public utilities in the United States but this is only natural in such a country of much greater distances, but we think that it is a sign of very considerable technical development in the economic use of this country's fuel resources that our industry should be developing its communications in this way. Undoubtedly it will mean a better use of available manpower and a higher load factor on our grid systems, in addition to making a fuller use of cheaper coal at the colliery.

To complete the picture Mr. Rimmer even envisages the use of telecommunications for accountancy information to centralised computers. This is a great step forward and should save a good deal of time, but will it really save paper work.

Commentary on the News

Koks i Khimaya

COKE AND CHEMISTRY, U.S.S.R., is the English title given to the cover-to-cover translation of the Soviet monthly journal, *Koks i Khimaya*, the first issue of which has just been published.

Produced by the Coal Tar Association in collaboration with the British Coke Research Associaion under a scheme sponsored by the Department of Scientific and Industrial Research, this publication is a big step forward in bringing information of developments in coking and by-product manufacture from behind the Iron Curtain to western scientists and technologists. Published at £1 a copy, or £5 5s. for a yearly subscription, it represents for a very reasonable outlay from the subscriber something of a 'break through' in providing translations of foreign journals for many who would otherwise be denied the opportunity of familiarising themselves with important technical matter published abroad.

The great importance now attached to Russian science and technology and the fact that very few are able to read even the script, makes the present decision by D.S.I.R. most timely and it is hoped that those interested will make good use of the opportunities offered them and so give every encouragement to the sponsors and translators to extend their activities into other fields of foreign technical literature.

Home heating at Olympia

THE Ideal Home Exhibition is a fascinating barometer of public taste and ambition. This year's show is no exception and reveals several clear-cut trends. One of these, perhaps the chief, is the desire for a higher standard of home heating. The reasons for this development are not hard to find. Greater prosperity, due in part to the increasing number of housewives going out to work, is leading to a growing dislike of unnecessary chores, coupled with an interest in on-tap, possibly automatic, fuels.

So we find at Olympia a marked increase in the proportion of exhibits devoted to central heating and other kinds of house heating. Nowhere is this more apparent than on the stand of the Esso Petroleum Co. Ltd., whose brilliant and costly advertising must be bringing even richer rewards; their Home Heating Plan is heavily featured. There is, too, brisk activity on the stands of the boiler makers, and in this connection particular mention must be made of the fine display of Thomas Potterton Ltd. and of a handsome new gas-fired Ideal boiler.

House warming is the theme of the Gas Council's pavilion where both small-bore central heating and controlled warm air heating are heavily featured. There is, we think, a shade too much whimsy and not enough realism about this, but we commend the greater spaciousness which seems to have been achieved on the stand this year by cutting down the ironmongery. It is also worth noting that both the Halcyon and Ductair systems are incorporated in houses in the 'village.'

Cookers usually predominate in the gas section and this year several models, some already familiar to the industry, make their first appearance at the exhibition, among them the Renown Seven and the Cannon with the Super Chef barbecue; even newer are the Cavalier and Leisure cookers of Allied Ironfounders Ltd. (General Gas Division) and the attractive little New World 33 of Radiation. The Coke Department of the Gas Council form a splinter group this year with a stand of their own, and the Council have retained their gallery home laundry stand which has a particularly nice décor. All told, it's a fine show. If you cannot get to see it, have a look at this month's *Gas Service* which will contain a special eight-page Ideal Home supplement.

Still running

IT is interesting to learn that 'Fare and Warm,' the successor to Radiation's successful cookery comedy 'Fare Play' is still going strong. Recently its subtle publicity for gas cookers, central heating systems, water heaters, space heaters and refrigerators was reaching audiences at Sale. The play had already played to capacity houses throughout the southwest from Truro to Bristol, and may well succeed in surpassing the record of its predecessor which toured the country for two years, notching over 400 performances.

The show follows the fortunes of a young couple before and after marriage, first in the girl's parents' home and then in preparation for their first dinner party in their own house. The players, Colin Morton, Anne Merry and Ian Anderson, are all well-established repertory actors and have appeared on films and television. Colin and Anne, who play the young couple, are themselves husband and wife and their comedy teamwork stems from their playing leads together in the Peterborough Repertory Company. Ian Anderson has played repertory leads at Oldham.

All the food cooked in the show and the wines accompanying it are served to the audience during the interval and after the peformance, the dishes including savoury confections of chicken and kidneys, as well as lemon meringue pie and that aristocrat among puddings, Crêpe Suzette.

PROBLEMS OF HIGH-PRESSURE COAL GASIFICATION IN GERMANY

IT is only in the post-war years that the problem of peak load gas has become a serious one for the German gas industry, since hitherto the load had been predominantly an industrial one. An increasing amount of heating load both in the domestic and industrial fields was leading to an ever increasing winter peak with only a small increase in requirement at the times of lowest demand.

Consideration of the economics of combined coke and gas production led Ruhrgas to decide upon the complete gasification of coal as one solution to this problem. Events in Germany and elsewhere have justified this action because while coke stocks are high there is an ever increasing demand for gas. Other methods of dealing with the question of reducing the peak load problem include the now well-known use of light distillates in water gas plants but reference is made to the use of light distillates for under-firing of coke ovens.

The article then goes on to describe the large Lurgi high-pressure coal gasification plant at Dorsten in the Ruhr. This plant differs from other proposed installations insofar as steam and power are imported from the nearby colliery. Unwashed coal is also fed to the plant direct from the screening plant at the pithead.

WEAKLY CAKING HARD COAL

This installation was designed to produce 42.5 mill. cu.ft. per day of a gas with a calorific value of 450 B.t.u. per cu.ft. when using five generators and enriching with natural gas. At times of peak output a sixth generator, normally used as a standby, could be brought into use with a resulting increase of 20% in output.

This Lurgi installation was the first one to be designed for the use of weakly caking hard coal. Other plants such as Sasol and Morwell were designed for brown coals or coals which had no caking properties at all. An essential feature of the Dorsten Lurgi generators was the incorporation of a stirring device for prevention of agglomeration of the fuel bed and a rotary grate which facilitated the extraction of the ash. The pilot plant at Holten had indicated that to ensure efficient ash extraction a high steam rate was required to keep the reaction temperature down and prevent the formation of clinker. The stirrer and the grate which were driven at different speeds were water-cooled, thus quite a lot of heat was extracted from the generator in this way.

IMPROVEMENT IN OPERATION

Experiments were carried out at Dorsten to try and reduce this loss and steam was used for keeping both the grate and the stirrer cool. A marked improvement in operation followed and further experiments were carried out to examine the effect of reducing the amount of gasification steam. It was found that the ash extraction was not impaired if small clinker was produced. The main benefit arising from this decreased use of steam was a considerably increased gas output, the gas containing less carbon dioxide but more carbon monoxide. Other benefits were a slightly reduced oxygen requirement and less effluent to be dealt with.

Table 1 shows what was achieved when this so-called dry method of working was compared with the original

Abstracted from *Das Gas-und Wasserfach*, 1959, August 8, 839, and *Brenstoff Chemie*, 1959, **40**, 74.

TABLE 1

Results of overloading generators

	Generators in use	Crude gas cu. m per hour	Natural gas cu. m. per hour	Load on purification plant		Oxygen requirement cu. m. per hour	Daily quantity mill.N cu. m. (at 450 B.t.u. per cu. ft. and a density of .48)
				Required cu. m. per hour	Available cu. m. per hour		
				Design capacity			
1. Continuous operation ..	5	50,000	8,500	58,500	70,000	8,800	1·120
2. Maximum load	6	60,000	10,000	70,000	70,000	10,600	1·350
				Possible capacity			
3. Continuous load	5	70,000	11,700	81,700	70,000	12,500	1·580
4. Maximum load	6	84,000	14,300	98,300	70,000	14,700	1·890

Capacity : Oxygen plant, two at 5,500 cu. m. per hour. Available oxygen 11,000 cu. m. per hour ; benzine (petrol) washer, 60,000 cu. m. per hour ; alkazid plant, dry purification potash washers, 70,000 cu. m. per hour.

TABLE 2.
Comparison of requirements and outputs of a pressure gasifier under various methods of operation

	Wet working		Dry working	
	Actual	per sq. m. per hour	Actual	per sq. m. per hour
1. *Material input*				
Coal throughput	160 tonnes per day	1·1 tonnes	~250 tonnes per day	1·7 tonnes
Coal distributor speed	15-16 rev. per hour	—	16-18 rev. per hour	—
Grate speed	3-4 rev. per hour	—	3-6 rev. per hour	—
O_2 for gasification	2,000 N cu. m. per hour	330 N cu. m.	2,900 N cu. m. per hour	480 N cu. m.
Steam for gasification (29 atm. at 320°C)	11·9 tonnes per hour	1·98 tonnes	11·2 tonnes per hour	1·87 tonnes
2. *Products*				
Grid gas at 450 B.t.u. per cu. ft.	~9,400 cu. m. per hour	1,560 cu. m.	~16,000 cu. m. per hour	2,660 cu. m.
Steam from jacket boiler	1·2-1·5 tonnes per hour	200-250 kgm.	1·5-1·8 tonnes per hour	250-280 kgm.
Waste heat steam (4·5 ats. 150°C)	10·0 tonnes per hour	1·67 tonnes	10·0 tonnes per hour	1·33 tonnes
Effluent liquor	10 cu. m. per hour	1·67 cu. m.	8·6 cu. m. per hour	1·43 cu. m.

N.B. 1 N cu. m. (wet) = 37·65 cu. ft. at 30 in. Hg. and 60°F. (wet).

method. It shows that the increase in output of gas obtained was over 40%, while oxygen requirements were increased by nearly 40%. Of great significance was the ability of the oxygen plant to meet the increased demand, and of the purification plant to accommodate this 40% overload of its designed capacity. Table 2 gives a comparison of the requirements and output of a pressure gasifier under various methods of operation.

SHIFT CONVERSION NECESSARY

As mentioned earlier, the 'dry' method of operation involves the production of a gas, high in CO (26%); even when mixed with natural gas this gas would be very toxic and shift conversion would be necessary to reduce this hazard. As shift conversion involves the production of one volume of hydrogen and one volume of carbon dioxide from one volume of CO, the removal of CO_2 from the shifted gas would yield a gas of the same calorific value as before but having a lower density.

A further increase in output could then be achieved by adding a mixture of refinery gas plus nitrogen to a maximum limited by gas quality requirements.

PEAK LOAD GAS CHEAPER

Table 3 shows what could be achieved if the CO content of the gas were reduced to 6%. The gas output when N_2 (from the oxygen plant) and natural gas are added is increased by 55% and the increase compared with the output as originally designed, with 'wet' working, is about 120%.

The article then goes on to point out that this peak load gas could be obtained more cheaply than the base load gas. This arises from two causes, one is that this additional output could be achieved with very little additional capital to that which was invested initially; the second is that the natural gas therms are cheap anyway. Even if these rich gas therms had to be manufactured they would be cheaper than the lean gas therms.

TABLE 3.
Increase in gaseous output which can be obtained when crude gas is subject to shift conversion

Type of gas	N cu. m. per tonne coal	Calorific value kcal per cu. m.	Specific gravity air = 1	Inerts %	1. GENERATOR
Normal operation					
Crude gas	2,230	2,850	·728	28	Minimum output 75 to 2,000 cu. m. per tonne=150,000 N cu. m.
Pure gas	1,675	3,800	·464	4	
Natural gas	325	8,900	·601	7	
Finished gas	2,000	4,600	·486	5	Maximum output 2,000 to 3,040 cu. m. per tonne = 608,000 N cu. m. per day 4.05 times that of minimum output
With shift conversion to 6% CO					
Crude gas	2,580	2,450	·714	38	
Pure gas	1,675	3,800	·273	4	
Natural gas (I)	325	8,900	·601	7	
Finished gas	2,000	4,600	·326	5	
Natural gas (II)	270	8,900	·601	7	
N_2	260	0	·972	100	
Finished gas A.	2,530	4,600	·420	14.6	
Natural gas (III)	540	8,900	·601	7	
N_2	500	0	·972	100	
Finished gas B.	3,040	4,600	·48	19	

N.B. 1 kcal per N cu. m^3 = ·1054 B.t.u. per cu. ft. at 30 in. Hg and 60°F.

GAS JOURNAL March 9, 1960

From a paper to the North of England Section, I.G.E.

Telecommunications in the gas industry

By G. M. RIMMER, M.Sc.(Eng.), M.I.E.E., M.Inst.Gas E., M.Am.I.E.E.
ELECTRICAL AND MECHANICAL ENGINEER,
WEST MIDLANDS GAS BOARD.

TELECOMMUNICATIONS, in most industries, are confined to speech transmission and, therefore, have a very restricted field of application; the notable exception is the electricity generating and supply industry where the term telecommunications is interpreted in a much broader sense as the transmission of an electric signal. This definition embraces telephony, telemetering, telecontrol, protective relaying and data transmission schemes over wires or space radio. This broad aspect has evolved largely as a result of the control and operational requirements of interconnected power generation, transmission and distribution systems: These functions demand both short and long time operative decisions and extremely accurate discriminative features must be provided over long distances. In short, a fast, reliable and co-ordinated communication system is essential. With the rapidly changing organisation of the gas industry and the consequent concentration of manufacture in large works feeding area grids operational methods are becoming more analogous to those of the electricity supply industry, and it is only to be expected that a co-ordinated communications system, on an area basis, will be required. In the future, with the promise of a national gas grid, the provision of a comprehensive national communications system can be foreseen.

Comprehensive mathematical theory

Fundamentally, a communications system must be capable of receiving intelligence in some energetic state, to code this state to a form suitable for transmission without undue distortion or attenuation, to transmit this state, subsequently to decode and, finally, to regenerate an energetic state which presents the intelligence at a distance in a suitable display form. In recent years, a comprehensive mathematical theory has been developed for this complex process which makes it possible to discuss all the various parameters quantitatively and enables a comparison of the performances of different systems to be made. This is known as information theory, and deals with such functions as multiplexing and coding in terms of bandwidth, noise, distortion, attenuation, speed and capacity; it can be technically complex particularly when dealing with the more advanced coding methods.

There are only two mechanisms by which intelligence can be transmitted through a medium or space, they are mass displacement and radiative action. Sound waves are an obvious example of the former, not so obvious, however, is the conduction of an electrical signal by wire which depends upon the movement of a free electron gas through the open molecular structure of the metal. In the case of radiative action, the signal takes the form of an electromagnetic wave—a so-called field effect—and does not require a material medium for its propagation. It should be appreciated that the heat radiated from the pie crust is the self-same phenomena but, of course, of shorter wavelength. Two of the most important properties of this electro-magnetic effect are its wavelength and frequency; they determine the characteristic form of the radiation and are given in Table 1 for a restrictive range.

TABLE 1.

Type of wave	Wavelength cm	Frequency Cycles/sec.
Electric waves ..	10^{6} — 10^{-2}	3×10^{4} — 3×10^{12}
Infra red waves ..	10^{-1} — 10^{-4}	3×10^{11} — 3×10^{14}
Visible waves ..	10^{-4} — 10^{-5}	3×10^{14} — 3×10^{15}
U V and X waves ..	10^{-5} — 10^{-9}	3×10^{15} — 3×10^{19}

They are seen to vary very considerably, and it is only to be anticipated that the physical properties of the radiation would exhibit widely varying characteristics. This is particularly in evidence with regard to their propagative properties and accordingly there is a very restricted portion of the spectrum available for telecommunication purposes, although research and the development of special techniques are continually extending this range.

The mechanism by which an electric signal is propagated, either by conduction through a wire or by a radiative process, does not obey Newton's laws of motion: The system of mechanics used is known as wave mechanics and identifies a particle or a pulse of electricity as a wave packet which spreads as it travels, thus giving the effect of dispersion of the transmitted signal as shown in Fig. 1.

Dispersion is one of the most important and significant parameters determining the performance of any system, the same phenomenon is observed in the interference phenomena of light. The effect is to provide effective 'pass' bands to a given band of frequencies—the so-called bandwidth—which is determined by the magnitudes and configuration of the resistive, capacitive and inductive components of the system. For frequencies both above and below this band there is effective suppression of the signal: The width of the band gives the range of pass frequencies and determines the quality of the circuit.

Second important parameter

Besides the signal which is impressed on the system, there is always present the random effect of spurious interference which may be due to other electro-magnetic influences outside the system or to thermal variations of the various components. This effect is termed 'noise'; it is the second important parameter to be considered and for a signal to be successfully transmitted, it must have a potential value below that of the signal.

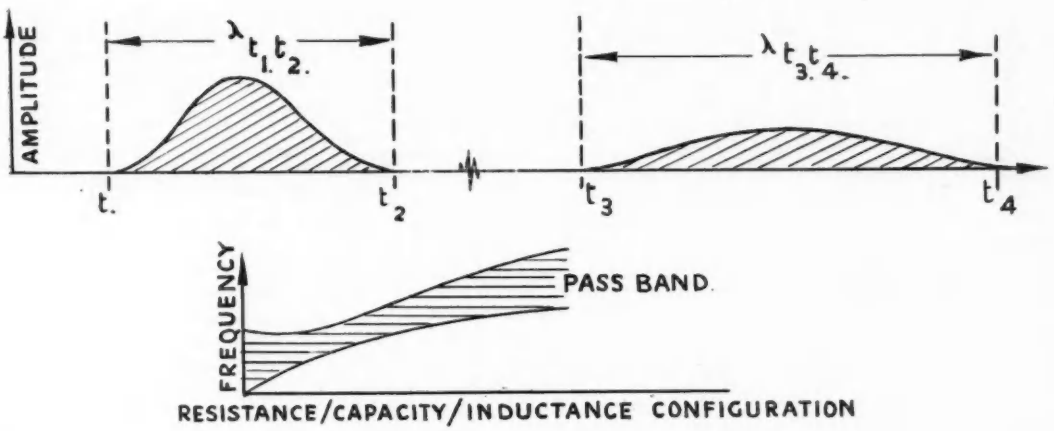


Fig. 1. Attenuation of a travelling wave packet.

Thus the bandwidth and signal:noise ratio, together, determine the performance of every system, whether of predominantly conductive or radiative mode. It may be noted that no system is purely conductive or radiative, each has essential components of the other so that in every case there is a compromise between conflicting dependencies. Designers, therefore, endeavour to reconcile such variables as speed of transmission, available bandwidth and tolerable noise levels; this is inexplicable to the inexperienced who invariably looks upon the transmission of an electrical signal as a unique predeterminable action which always produces a positive result with the speed of light.

Power of the signal

Finally, there is the question of the power of the signal which attenuates as it progresses through the system: Clearly, it must be in excess of the noise energy at any point and of such a magnitude at the receiving end as to be capable of operating the receiving apparatus at the requisite power level.

It has been seen that there is a restricted range of pass band frequencies so that it becomes necessary to analyse the information to be transmitted in terms of its rate of change from one significant value to another. To enable this analysis to be carried out in terms of harmonic elements, the concept of a frequency spectrum is introduced using a Fourier series. Thus, a series of sinusoidal functions is obtained which when superimposed give the original function as is shown in Fig. 2. If the intelligence is periodic with respect to time when the series will consist only of the fundamental frequency and its harmonics, the magnitude of the harmonics varying with the form of the intelligence.

A bit of information

This analysis will give the maximum and minimum frequencies or the bandwidth of the signal with which the telecommunications system has to cope. The form of the signal may be continuous or it may consist of discrete samples, in the latter case it is necessary to know the rate at which the series of samples must be taken in order to recover precisely the original form of the signal. The sample will be taken over a finite time, let the number of samples taken per second be 'n,' then $t = \frac{1}{n}$ is the sampling period, and it may be shown that the sampling rate 'n' must be greater than twice the highest Fourier component frequency of the intelligence signal (f). In practice it is usual to sample at a rate n = 2.5f. It will be seen that each sample is in reality a square-topped pulse whose frequency spectrum is being compared with the frequency spectrum of the original intelligence; this sample is termed a 'bit' of information. Now, by means of a statistical form of analysis a measure of the informa-

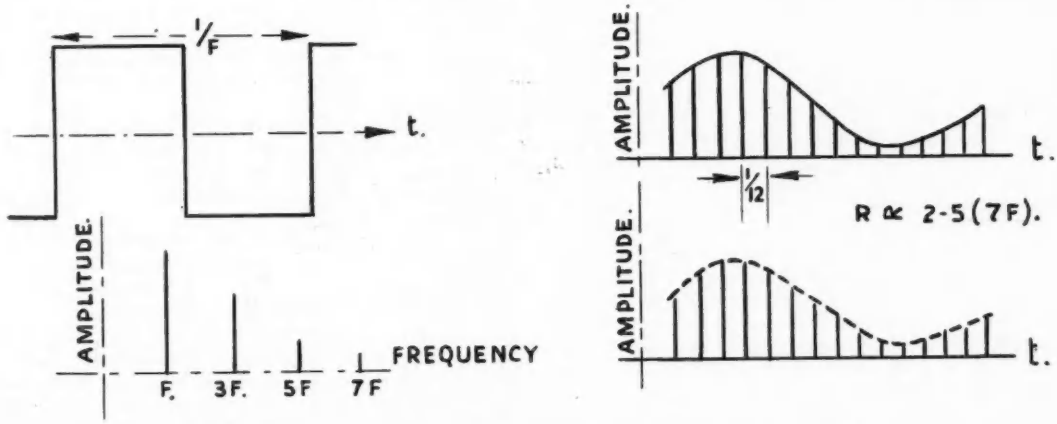


Fig. 2. Fourier frequency components of a function and recovery rate

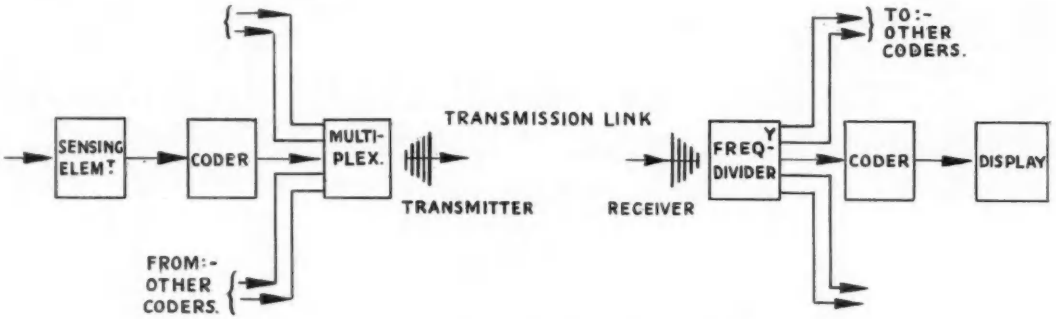


Fig. 3. Simplified block diagram of telecommunication system.

tion capacity of the system may be obtained, it is given by the equation

$$(1+\tfrac{S}{N})^{2W} = Z$$

where:

Z = the number of different one second messages.

$\frac{S}{N}$ = the signal:noise ratio (potential level).

W = available bandwidth of the system.

The usual method of stating this relationship is:

$$I = 2W \log (1+\tfrac{S}{N})$$

where I is termed the information capacity of the system. This sample 'bit' system is used exclusively in binary systems when the expression for information capacity is:

$$I = 2W \log_2 (1+\tfrac{S}{N})$$

and gives the number of bits per second transmitted by the system.

The above is only an approximate solution but is sufficiently accurate for estimation purposes; frequently the approximation $I \simeq 2W$ is quoted since the bandwidth W is the most significant dependency. Now the value of N varies as the square root of W and, therefore, there is a limiting value of W above which little improvement is made in I, this occurs when $\frac{S}{N} < 1$.

Every communication system has the following basic components arranged in the sequence shown in Fig. 3.

It is seen to begin with a sensing element which presents the intelligence—say pressure change—as an electrical signal essentially in a form convenient to the physical sensing of the prime variable. For electrical variables, such as the current (amps.) of a pump motor, there is no mechanical mechanism but there may be a thermal mechanism, alternatively, the current may be used directly so that the sensing element may consist of no more than a calibrated resistance. A very comprehensive list of prime variables and their derived quantities have already been given by the author in an earlier paper*, they will not therefore be repeated here.

The form of this derived electrical signal is thence fed into a coding device where it is changed into a form suitable for modulating a transmitter. This unit is in reality an electrical matching unit, thus if the sensing unit presents a direct current signal and the coding is by frequency modulation the coder will change the signal from a variable direct current to a variable frequency alternating current. The type of coding used will depend upon the mode of transmission and the nature of the intelligence to be transmitted. For instance, modulation may take the form of a change of amplitude or frequency of an alternating current; these are simple and well known forms, there are, of course, more sophisticated methods which use pulsing techniques. The coding of these pulses may be in numerical sequence, in width, amplitude spacing and unique sequences such as the binary code. One or more of these methods may be employed in a single system which will require a suitable combination for the characteristic bandwidth requirements of telephone, telemetering, control and data handling functions.

Multiplexing system

The system considered so far has only dealt with one single piece of information—say a pressure—invariably there are a number of sets of information to be transmitted and to meet this requirement a multiplexing system is provided which enables a number of sets of information to be transmitted simultaneously. Multiplex equipment, therefore, produces a number of parallel or series channels which receive the outputs of several separate sets of coders, ultimately inserting them into a common transmission band. Finally, at the sending end the transmitter provides a carrier pass band upon which is superimposed the output of the multiplexing equipment.

The carrier signal duly coded by the intelligence is passed through the transmission 'link' to the receiving end station where the transmitting processes are repeated conversely and in reverse order finally presenting the information in some display form. The link may be in the conductive or radiative modes using the conventional pair of wires or space radio respectively; it may also be of composite mode, that is a radio frequency guided by wire or tube, depending upon the particular range of the radio frequency.

Many components appear to be conditioned by close ties with telephone practice. Thus there are available the well known mechanical devices, such as selectors and stepper switches, which are quite satisfactory for the transmission of slowly varying data: they are simple, have been proved reliable and are relatively cheap. At the other extreme, there are the modern digital components which are conditioned by computor and data processing techniques; these are usually complex and expensive but are versatile in the extreme. Between these two limits there are a variety of systems—some more elaborate than others—the essential differences, however, are confined to the coding and multiplexing functions which in turn are conditioned by the available bandwidth of the transmission link.

Multiplexing has been shown to be necessary for two

* 'Electronics in the Gas Industry.' Midland Section, I.G.E., October, 1953.

reasons, first, to provide sub-channels which enable a single link to be used for the simultaneous transmission of different types of intelligence and secondly, to enhance the information capacity of the system. In principle there are only two co-ordinates that can be sub-divided, they are space—in terms of frequency—and time; both may be, and are frequently, used together.

Possibility of cross-talk

In frequency-division, separate sub-channels are created by the use of limited frequency bands, thus a wire channel having a 'voice' bandwidth of 3 k/c can be divided into thirty sub-channels each of width 100 cycles so that thirty sets of information can be transmitted simultaneously provided that the information can be coded in 100 cycles. This is the theoretical picture which looks very attractive. in practice there is the possibility of interference between sub-channels—known as 'cross-talk'—which limits the effective number of channels that can be obtained by this method. There are other technical restrictions, such as line linearity, which, together with cross-talk, reduce the available number of channels to a fraction of what may be expected in theory. Each separate sub-channel has, in effect, a separate sub-carrier frequency which requires modulating with intelligence, thus each sub-channel must be provided with its own coding device. A typical frequency multiplexing arrangement is shown diagrammatically in Fig. 4, it will be seen that a primary division is made on a 'voice' bandwidth of approximately 4,000 cycles with secondary sub-divisions of approximately 110 cycles, the latter are primarily for the narrow band slow telemetering functions and are usually referred to as 'tone' channels.

With time-division multiplexing, a single channel is switched at both ends to the outputs of several coded channels; the period between each switching point is carefully controlled as is the dwell period on each coded channel. The information is provided in the form of sample pulses which are used to modulate the single carrier in sequence. This method is very often used in conjunction with frequency division to provide the sub-sub-channels for telemetry, in which case mechanical commutator type switches are employed. For faster digital techniques wide bandwidths are essential and the full width of the primary channel may be employed without frequency multiplexing. In this case electronic switching is essential with the use of transistors for the relatively slower functions and beam switching tubes for speeds in the megacycle range. As with frequency division, cross-talk —due to overlapping of the pulses on adjacent channels— is experienced which limits the number of sub-channels that can be obtained in a given bandwidth. The remedy is simply to create time spaces between the pulses, but, of course, this may be using up intelligence capacity so that there is no nett gain. Both ends of the switching process must, of course, be synchronised and this is achieved by using specific pulse codes within the system, and together with parity and identification checks, reduces the capacity still further. Time multiplexing offers many advantages for telemetry purposes; thus, it is possible to record immediately following the switching operation at the receiving end, the sample pulses can also be integrated directly by a resistance capacity network and an average continuous signal obtained. This is known as the 'cup and bucket' system and is used extensively in the electricity generating industry. Particular reference may be made to the use of the beam switching tube for the switching process, this is being developed for fast on-line computer operation and it is interesting to note that there is one telemetry installation in Canada where this method has been in use for about a year with complete success. The major advantage of this time multiplexing method is, of course, the use of 'time' as an intelligence parameter, thus there is virtually no limit to the number of variables that can be handled provided their rate of change is slow; for on demand, on/off indications and operative functions the range is quite unlimited and there is little doubt that this system, coupled with digital coding in the binary series, will prove to be one of the most suitable methods for the gas industry.

Coding techniques are concerned with the receipt of an electrical intelligence signal and its conversion to a form suitable for transmission; they include 'modulation' of the carrier wave. The dependence of coding methods upon the type of transmitting link is therefore very strong, they also influence the 'noise error' factor most profoundly. The mathematical formulation of the coding and subsequent decoding process—from information theory—is as follows:

Coding:

$$F_t = C(f_t)$$

Decoding:

$$f_t = C^{-1}(F_t)$$

where:

C is some functional operator, and F_t and f_t are functions of time (t).

While these functions appear as strict inverses in theory,

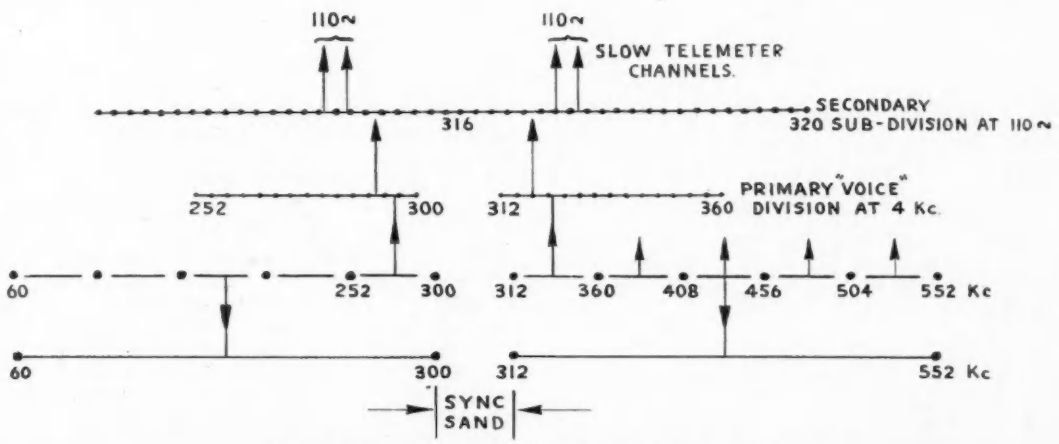


Fig. 4. Typical frequency division multiplexing scheme.

the practical processes are not so well behaved in that there is a difference between the send and receive times of a signal. The more accurate function is therefore defined:

$$F_t = C(f_{t-td} + e_{t-td})$$

where:

t_d is the coding and decoding time delay and
e is other error conditions.

The function operator C can be assessed according to the temporal relationship of the predominant physical process involved; it is usually a combination of both linear and non-linear functions.

Coding methods

There are various methods of coding.

1. *Amplitude modulation* (*A.M.*). In this method, a constant frequency signal of varying amplitude is added to the constant carrier frequency, the intelligence being contained in the variable amplitude; this is the traditional method used in sound broadcasting. The frequency and variable amplitude of the signal have limits which are set by the carrier frequency and amplitude respectively. The bandwidth of the carrier channel is twice the signal frequency unless one side band is suppressed, a process which economises in bandwidth and power but is difficult to apply to telemetry with a slow data rate. Demodulation is carried out by a simple rectification process which, after suitable smoothing, gives complete decoding. The noise factor has been seen to be proportional to the square root of the bandwidth and accordingly this should be maintained as narrow as is consistent with the data rate.

2. *Frequency modulation* (*F.M.*). If the frequency of the carrier wave is allowed to change, a frequency spectrum will be introduced into the system whose amplitudes rapidly decrease to zero on either side of the centre or carrier frequency, which gives a very effective wide bandwidth with low noise loss above a given threshold. This is the system used on V.H.F. sound broadcasting which gives a signal: noise ratio gain of up to 100% over A.M. systems, but at the expense of increased carrier signal strength which is required to compensate increased noise on the greater bandwidth. This is effected by injecting a constant amplitude variable frequency signal on the carrier wave, the intelligence is contained in the variable frequency.

3. *Phase modulation* (*P_h.M.*). Precisely the same effect as frequency modulation can be obtained by using a constant modulating frequency signal but allowing its phase —in time—to change. The required bandwidth is then proportional to the modulating frequency for a given phase change. Phase modulation can be obtained from F.M. by differentiation whilst F.M. can be obtained from P_h.M. by integration. Noise improvement is not as good with F.M.

Pulse modulation (*P.M.*). The foregoing methods (F.M., A.M., P_h.M.) all deal with continuous waves and require continuous carriers: pulse methods are essentially discontinuous, the intelligence being contained in the following parameters.

a. *Pulse amplitude* (*P.A.M.*). A sample pulse is obtained whose magnitude (height) varies with the prime signal. This pulse may be transmited direct at regular intervals and decoded by integration—P.A.M.—alternatively it may be impressed on to an A.M. system or an F.M. system giving

P.A.M.—A.M. or P.A.M.—F.M.

In P.A.M.—A.M. the carrier is only operated with the pulse, otherwise these systems compare with single A.M. and F.M. systems.

b. *Pulse duration* (*P.D.M.*). The magnitude of the pulse is now used to generate a pulse of constant amplitude but varying width which then modulates the carrier. In the case of P.D.M.—A.M. the carrier is just turned on and off giving the pulse time directly, with P.D.M.—F.M. and P.D.M.—P.M. the carrier is turned to full modulation in one direction during the pulse and then to the other direction during space.

c. *Pulse position* (*P.P.M.*). This is a variation of P.D.M. where the leading and variable edges of the pulse are replaced by short pulses—thus economising in output power. As the pulse size is reduced, there is always the problem of providing adequate power within the pulse and associating this with available bandwidth and noise levels. Since this principle is employed to conserve power it is only used with A.M. since both F.M. and P_h.M. occupy considerably longer times than A.M.

d. *Pulse code* (*P.C.M.*). The foregoing pulse methods have been related to methods which sample—at a predetermined rate—continuously but slowly varying functions and which subsequently reproduce the original functions; they are, therefore, analogue presentations.

In all these methods the bandwidth/noise relationship is not favourable when performance is compared with the available system rate; pulse code methods are designed to improve this position. Their main limitation, however, lies in the presentation of a finite number of symbols for a finite number of possible values of the information, there are also other aspects, relative to power, which are not so satisfactory.

The binary series is the obvious electrical choice because of the simple on/off state of the electrical representation of a yes/no signal and the code is transmitted as the presence or absence of a pulse in a sequence of N pulses: thus a pulse indicates 1 and its absence 0 (see Fig. 5).

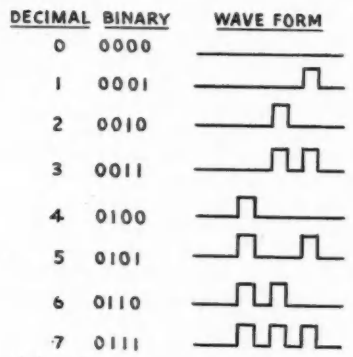


Fig. 5. Binary digital code.

The number of different values available is therefore

$$2^N$$

where N is the number of pulses in a code group. With regard to noise, as long as the magnitude of the signal is greater than the noise, the final output is assured but there is always present the error due to digitisation. The signal: noise ratio increases rapidly with N and the bandwidth is

$$\frac{NF}{2}$$

where F = pulse rate. This code is used with A.M., the carrier being full on when a pulse is present and with it off there is a space. This method offers technical advantages to storage and digital computation applications.

(e) *Predicted wave code* (*P.C.M. P_h.M.*). A more efficient means of coding binary information employs a combination of pulse code modulation with phase modulation and enables a single pulse to carry two bits of information. The signal pulse can be envisaged as a linear function of two co-ordinates X and Y in one plane, the

phase angle being changed rapidly from pulse to pulse while remaining constant during a pulse. Thus, these (X. Y.) co-ordinates give two 'bits' of information. The bandwidth required for this type of coding is

$$\frac{1}{t}$$

where t = time width of pulse, the actual performance obtained over standard voice frequency wires being of the order of 3,000 bits per second using 20 channels spaced approximately 100 cycles.

The foregoing treatment of coding and modulation methods is essentially elementary, it should not be assumed that the techniques stop here, neither should it be assumed that the data obtained from the processes mentioned can be interpreted uniquely without ambiguity. There are many pitfalls in every system, even the simplest two-wire scheme has its problems and when the selection of a given scheme has to be made comparison is indeed difficult. In every case, the optimum information capacity of a system depends in some manner upon the bandwidth and the signal to noise ratio, these properties can only be improved at the expense of each other; information capacity, however, is not the only criterion of performance as will be seen later.

Having transmitted the signal and received it at the far end, it is necessary to translate it, that is to decode or demodulate the carrier. The process is precisely the reverse of coding, thus as the coder mixes the decoder must filter and this is a relatively straightforward electrical conduction process using circuits which resonate to the particular band of pass frequencies which were used at the transmitting end. Alternatively, if pulses are used circuits have calibrated holes for the pulses to drop into. The details of these circuits are given in any text book on electronics, they are termed 'flip flops,' 'gates,' etc. There is one essential mechanism to all forms of decoding systems, however, and that is synchronism of the transmitted and received signals so as to present identical characters. In some methods no more than a delay-time calibration is required but with pulse techniques the code must contain its own synchronising pulses. In addition, parity checks need to be inserted which invariably require the decoder to code out its own identity to the transmitting station before receiving a message or some data. Thus the design of a coder invariably includes a decoder and *vice versa*.

Analogue and digital instruments

Data presentation implies a read-out of some form. In the past telemetry read-outs were usually standard electrical instruments of the analogue type; today, however, there are available both analogue and digital instruments giving storage indication, and automatic 'on' or 'off line' data processing facilities. Data recording on film, punched tape and 'sound' on magnetic tape is quite common; oscillographic records can be obtained quite readily.

So far no reference has been made to any specified mode of transmission, though what has been said applies to all electrical forms of transmission link—'wired' wireless or space radio.

In dealing with such transmission systems, it must be realised that, in this country, all forms of wired or space radio communications are controlled—in some manner—by the Postmaster General on behalf of H.M. Government. There is, therefore, what may be termed a political influence quite distinct and unconnected with any technical aspect; it is a controversial subject of no mean issue. The available means of transmission are:

1. *Private wires (G.P.O.).*—Single pair circuits are readily obtained on a rental (annual) basis from the G.P.O. at approximately £15 to £10 per mile, the bandwidth of these lines is of the order of 3 k/c, but there are restrictions on the electrical parameters which may be employed; these are detailed in the relevant G.P.O. specifications. These lines are readily obtained, providing they are available; they are not subject to maintenance procedure of any kind but priority emergency service is readily available during normal working hours. These circuits are designed explicitly for public telephone duty and there is no special treatment or protection offered.

Lines with a bandwidth of the order of 12 k/c—'music circuits'—can be obtained on certain routes but, of course, at a higher price. These have been frequently used by the electricity generating industry and are considered to be highly reliable.

2. *G.P.O. public telephone circuits.*—Normal telephone installations may be used for data transmission but only according to a very restricted specification. Prior to new provisions issued within the last six months, it was necessary to interpose speech into the data. Accordingly a number of systems have been developed specifically for this duty using pre-recorded data on disc or tape.

3. *Radio on wire (guided radio).*—There are no limits or controls over this method of working on privately owned lines other than a G.P.O. restriction on the radiated power and its frequency spectrum. These methods are used extensively on the overhead line systems of the electric supply industry and are termed carrier systems. Modern techniques employ tubes within which the radio waves are guided—hence the term wave guides. The bandwidth of this method is almost infinite and is hailed as the system of the future—a 3 in. diameter tube has been estimated to be capable of multiplexing to 10,000 mill. voice channels.

4. *Space radio.*—For the mobile application, the gas industry has available in the V.H.F. band six channels, as shown in table 2.

TABLE 2.

Channel No.	Low Band	Channel No.	High Band	Remarks
1	85·275 M/c	2	165·25 M/c	Base station frequency. (25 k/c channels)
3	85·25 M/c	4	165·275 M/c	
		5	165·325 M/c	
		6	165·3 M/c	

These are of a bandwidth 25 k/c and it has been necessary to organise the arrangement of these frequencies throughout the country so that interference does not occur. All six frequencies have, therefore, been allocated to each area board so as to cater for sub-area requirements and have been arranged to have a space repetition rate of not less than 40 miles. Two frequencies are seen to be in the 'low' band and four in the 'high' band—unfortunately the propagation values in the high band have been deprecated by some manufacturers and users, but this has never been accepted technically and has certainly not been borne out by experience—particularly in America where operation is on the higher bands of 450 M/c. All available British experience points to completely satisfactory performance with the high band equipment so far used.

The response by the gas industry following the allocation of these six frequencies has been little short of tremendous—in the space of less than one year planned coverage is probably 90% of the whole country including Scotland and Wales. Coverage so far achieved for sales and service and operational purpose is probably 70%. It is fairly safe to state that the mobile radio application in the gas industry is now on an equitable basis with other industries and should give the experience and incentive to its further

development. It should be appreciated that these frequencies are available for the sole use of the gas industry and an attempt must be made to fill this 'transmission pipe line' of the radio channel to its capacity, and this course implies a high rate of working—a figure of 100 mobiles per fixed transmitter is achieved in America.

Undoubtedly operational techniques on the air are verbose, for instance 'Gas-base to Charlie come in' repeated twice or three times is the usual outgoing call to be followed by 'Charlie to gas-base' also repeated and probably adorned with some local gossip or news of Charlie's Aunt! A recent check on message times gives an average of 1½ minutes per message, this is to be compared with a 10-second message time achieved in the U.S.A. With exclusive channels, as used by the gas industry, it should only be necessary to use a numerical code and to call, say, '25' repeated at most twice, followed by '25 in.' from the mobile.

Even with the most heavily saturated systems, however, on a mobile bandwidth of 25 k/c less than 25% of available time/space capacity is utilised. This low utilisation factor has been recognised by the Post Office which, of course, makes it difficult to present a valid argument for further channelling allocations. It has also been recognised by the Radio Committee of the Nationalised Fuel and Power Industries and due consideration is being given to this point by the manufacturers. Clearly, there is a restricted amount of a 'mobile' channel available which, when guard bands are allowed for, is possibly less than one voice channel and there may be some difficulty in multiplexing on these mobile systems. However, there is the method of time multiplexing which for telemetering duty can be exploited with great advantage, but the equipment must be relatively fast, normal mechanical devices may be too slow unless storage facilities were provided.

The coding technique most suitable would appear to be of digital form, using the binary series and manufacturers have already produced suitable equipment. The scanning would not be continuous but would be selected as required or to a given programme; control functions could be given without interfering with normal mobile operation.

Costs could be reduced

This scheme would be a very great attraction not only to the gas industry—for outlying stations within a radius of about ten miles—but is just the type of equipment that is required by the electric supply industry to deal with control and telemetering functions on their sub-station plant. The potential usage of this type of equipment is therefore exceedingly high and the manufacturers should be able to manufacture very economic units on a mass-production scale and thus reduce very substantially present-day cost of this type of equipment.

For the fixed to fixed application, there are no frequency allocations by the G.P.O. to any of the fuel and power industries except where line facilities are non-existent. This condition is the main criterion of frequency allocations by the G.P.O. for fixed to fixed use and the stark result of this situation is that Great Britain is several years behind other countries—particularly America—in the application of radio techniques to utility control functions. It is possible that this position has been realised since it is only quite recently that the Postmaster General has made an extensive survey of American telephone practice and there is evidence that his findings are already being implemented in this country. The argument presented by the G.P.O. is that every case must be considered on its merits and in this respect the utilities may be guilty of prejudging too readily what they consider to be an inevitable result. However, so far it has been impossible to assess precisely what these merits are, they are certainly not connected in any way with economics which is the main argument presented to and accepted by the F.C.C.—the frequency allocating body of America.

Efforts are now being made by the Joint Radio Committee of the Nationalised Fuel and Power Industries to obtain suitable and firm frequency allocations in the 450 M/c band for fixed to fixed links of the mobile installations and in the microwave bands (6,000 M/c and over) for telemetering, control and other data handling functions.

5. Microwave systems.—A microwave system—over 1,000 M/c and generally around 6,000 M/c—offers the most reliable and economic backbone for a multi-channel telecommunications system, and this fact is unassailable. Microwaves resemble light waves in many respects and may be focused in a narrow beam from one point to another by means of parobolic reflectors which act as transmitting and receiving aerials. Like light waves, they travel in straight lines and can be beamed from one repeater station to another, over many hundreds of miles, along predetermined paths. The initial capital costs are less than wired systems offering comparable facilities—taking into account the wide band available—they are also more reliable and are unaffected by adverse weather conditions such as ice, snow, rain and thunderstorms.

Ensures absolute privacy

The directivity of the radio beam and the scrambling of the intelligence by the multiplexing equipment ensures absolute privacy so that all district offices and remote operating stations can be tied together to give continuous two-way communications and transmission of all control, telemetry and data processing functions. Both wire and mobile systems can be integrated into the system to give a most comprehensive communications network. The experience of the many radio manufacturers engaged in this field has ensured system designs which are simple, economical and reliable; at the same time, the high capacity needed to avoid obsolescence can be achieved by virtue of the wide channels which are available in the microwave spectrum.

Generally, the equipment consists of a limited number of building-brick basic units—about 12 in all—which can be assembled on standard racks; the units are interchangeable so that repairs on site consist only of unplugging the faulty unit and re-plugging in the spare. Both transmitting and receiving apparatus has been developed specifically for unattended operation and may be installed at locations which are not readily accessible during severe weather conditions. Weatherproof housings, towers, emergency power equipment can be of standard types; all are easy to install and maintain.

Because of the nature of the information transmitted, the microwave system needs to be continuously operative and so requires 100% standby equipment. For the radio side this can be one of three types, (a) cold standby giving several minutes' interruption, (b) semi-cold standby giving several seconds' interruption, (c) hot standby without interruption of service. They are brought into operation by failure-sensing circuits quite automatically and are then alarmed at some convenient control centre. Fading-out is catered for by continuous operation of the standby equipment on a frequency or space diversity basis—obviously such breaks due to fading or improper operation must be kept to a minimum.

Microwave design is based on a number of considerations. Probably the most important is the frequency of the radio signal which controls such variables as antenna proportions, ground clearances, width of beam and consequent gain in antenna and channel capacity. Most manu-

facturers have specialised in particular wavebands—1,000, 2,000 or 7,000 M/c—although some do cover the whole series for other than industrial use.

A microwave station comprises the same basic equipment as any multi-channel communications system already described. The radio frequency equipment provides a basic wide-band carrier channel, which may be 1 to 2 M/c, while the multiplex equipment divides this carrier into sub-carrier channels. Each 'sensing element' providing the input signal—of voice, teletype, etc.—is fed to its own low frequency transmitter (sub-carrier transmitter), which in turn feeds the multiplexing equipment and is thence added to the B.F. carrier. At the receiving end similar equipment separates the R.F. signal into the original component channels.

The frequency division of the base band generally follows 'voice range' of approximately 3 k/c—standard voice channel—and is suitable for telephone service, each being capable of sub-division at approximately 100 cycle increments to give 30 telemeter channels. Different manufacturers have variations of this technique to give predominance to specific telemeter, voice or data handling requirements. Throughout the system, channels can be inserted at will without a great deal of equipment—up to full bandwidth—at the base and repeater stations.

At the lower end of the scale, the 1,000 M/c systems have generally been designed to be as simple as possible with a base load of no more than about five voice channels and/or the equivalent telemeter chanels, and to be operative over distances of the order of 25 miles with maximum transmission distances of about 100 miles using three repeater stations. At these frequencies conventional triodes may be employed without a regulated power supply and amplifier stages are more economical. Antenna accuracy is of a lower order—though still of close tolerance—and, therefore, towers are somewhat less costly. On the other hand natural antenna gain is severely limited and passive reflectors cannot be utilised.

Such limited types of equipment are reputed to be less than one third the cost of conventional wired lines. As the frequency increases the R.F. beam becomes narrower and the signal more concentrated, thus amplification in the antenna is higher and the antennæ are of smaller dimensions. Equipment in the 2,000 M/c range is substantially the same as in the 1,000 M/c, but has greater range and more antenna gain and is therefore recommended for single hops of approximately 40 miles. In the 7,000 M/c range the use of reflex klystrons is essential; they have been proved reliable and a life of 20,000 hours is freely quoted.

Ultra-conservative reliability

This range offers a potentially greater base bandwidth and therefore greater channel capacity; thus with single side band suppressed carrier modulation, standard equipments can readily cater for approximately 250 voice channels. Operationally, there is an improved signal to noise ratio, improved gain characteristics and low wave guide losses at these higher frequencies. These advantages enable the equipment to be run ultra-conservatively and so reliably. This type of equipment is used over hops up to 60 miles and is the most popular system with the utilities in the U.S.A. There it caters for over 50% of the communications systems and is now used almost exclusively on new installations.

The most convenient band for the gas industry's use would appear to be in the neighbourhood of 7,000 M/c since it is very sparsely occupied in this country and would therefore receive favourable consideration by the G.P.O.

There is no single or ready answer to the question what is the best telecommunications system for the gas industry, since it is usually impracticable to try to fit a given system into an existing organisation. Telecommunications are a powerful tool in their own right and must be considered as such when being integrated with other operational facilities which are considered vital to the continuous operation of plant and maintenance of consumer obligations.

Private wire link inadequate

Existing facilities are limited to mobile schemes for sales, service and distribution functions and to random wire 'links' for telemetering and control of remote plant. While mobile equipment can be multiplexed to give a 'local' telemetry and voice facility, there are serious limitations to the use of wire links for a comprehensive scheme.

Now, while the physical conditions vary from board to board, the operative functions are broadly common and consist of operational control of plant and personnel, both locally and remotely, for: (a) Manufacture, (b) transmission and distribution, (c) sales and service (gas and coke), and (d) accountancy. In addition, with a national gas grid in operation, an interlink between area boards would be required. These functions may be outlined briefly as:

1. Manufacture.
   a. Instrumentation at the works to be presented to some near control point, data processing and subsequent automatic control functions by remote control.
   b. Voice communication to and between selected personnel—mobile and fixed.
   c. Load despatching.
   d. Facsimile for record transmission.
2. Transmission and distribution.
   a. Remote telemetering and control functions.
   b. Voice communication to mobile personnel.
   c. Voice communication for transport control.
   d. Voice communication for grid control.
   e. Data processing for grid control.
   f. Facsimile for record transmission.
3. Sales and service.
   a. Voice communication for consumer complaints, mobile.
   b. Voice communication for consumer deliveries—transport control.
   c. Voice communication for consumer orders.
   d. Data processing on consumer orders.
   e. Facsimile for record transmission.
4. Accountancy.
   a. Data processing for central accounting functions, including billing.
   b. Data processing for transport programming.
   c. Facsimile for record transmission.

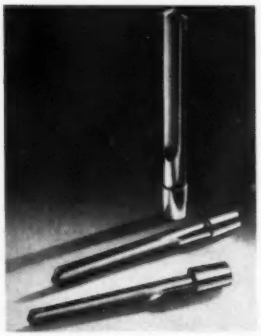
The predominance of voice and data processing duties is clearly shown, so the system must be conditioned by the relevant technical factors. For telemeter and telecontrol functions with associated data processing a digital pulse code technique the best solution is offered by using the binary system of notation. Although this technique replaces the age old analogue type of instrumentation by a digital presentation there are overwhelming advantages. As an instance of this, one single print-out machine could replace all the recording instruments on a number of works!

Here is yet another specialised function being offered to the gas industry. If it is accepted and considered as other previous specialised functions have been in the past, there is little doubt that it will prove to be one of the most powerful, versatile and economic tools that the industry possesses.

Technical developments

Drill developments

THE abrasive nature of such hard materials as concrete, blue bricks and some stones entails the use of special drills to produce holes quickly and cheaply. The modern tendency to make concrete ever harder, has necessitated new thinking in both design, and in the type of tungsten-carbide used for the tip.



Heycon hammer drills.

The high tensile steel shank is of an entirely new shape and, with the tungsten - carbide tip, specially developed for use with the Heycon hammer drill, has produced a percussion drill which, by presenting a minimum of cutting surface, lessens resistance at drill point and allows rapid penetration.

Extensive tests have shown that with the Heycon hammer drill, deep holes can be obtained in tough well seasoned concrete, up to 50% faster than with the conventional 'star'-type drill. The new Heycon hammer drill, which can be employed in any existing hammer-drilling machine, guarantees a true round and size hole, and excellent final clearance.

Heycon drill attachment.

Another development is the Heycon hammer drill attachment which will convert a rotary drill into a percussive hammer drill. It converts the drill into a hammer action equal to two blows per revolution.

The rotary movement imparted automatically to the drill head, obviates manual rotation and ensures good clearance of drilled matter and a true round hole. An electric drill running at a speed of between 1,500-2,400 r.p.m. is recommended.

The attachment is fitted with a scroll type chuck and key, and will hold parallel shank tools. The use of special polytetrafluoroethylene dry bearings, impervious to dust and grit, makes oiling or greasing unnecessary, and eliminates site maintenance. A very long life is ensured, since bearings cannot be worn out through operator negligence.—*H.E. (Instruments) Ltd.*

Advanced cooling tower

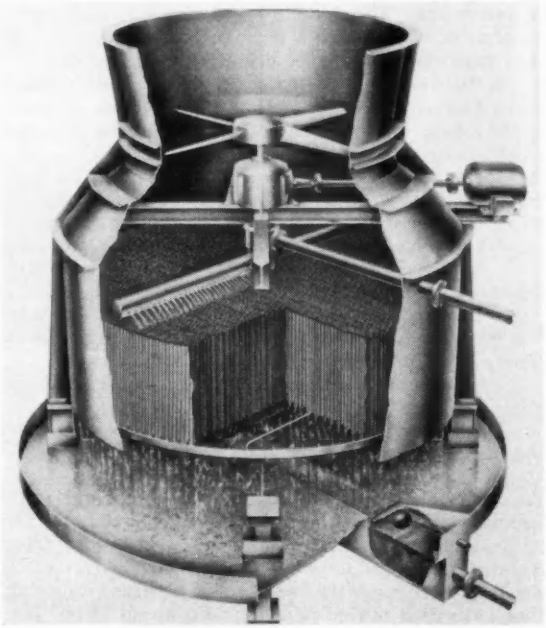
A MAJOR advance in the design of cooling towers is marked by the announcement of a completely new type of tower, weighing less than half as much as conventional towers of similar capacity. The saving in weight, and in size, is achieved by the use of a fill material in which the water is cooled by a counter-current of air as it passes through very closely-spaced elements.

The tower, circular in shape, contains a top-mounted fan which draws air up through it from the bottom. The fill, resembling a honeycomb in its structure, is arranged across the inside of the tower with the channels disposed vertically, and the cooling air passes up through these channels. Water entering the tower at the top is distributed across the surface of the fill by a centrally-mounted rotating header pipe containing a number of perforations along its length through which the water streams on to the fill. The perforations vary in size along the length of the header to ensure an even distribution of water.

The material of the fill has a high wettability, and the water passes down the walls of the channels in a thin, continuously-moving film. This ensures the maximum area of contact between the rising currents of air and the water, thus utilising the volume of fill to its greatest capacity. A catchment tray at the base of the tower collects the cooled water for return to the appliance in which it is required.

The fill made from alternate flat and corrugated sheets of a plastics-impregnated cellulose material is built up into rigid units requiring only a very light supporting structure at the base, without need for bracings.

The very large number of channels in every square foot of fill presents a very extensive cooling surface for the water to flow over, and its high wettability causes the water to adhere to the walls of the channels, allowing a free pasage for the upward air currents. This continuous film of water keeps any foreign matter in suspension in the water, thus preventing choking of the narrow channels. Drainage from the bottom of the fill is accomplished by providing for serration of the lower face.



Sectional model of a Thermotank cooling tower.

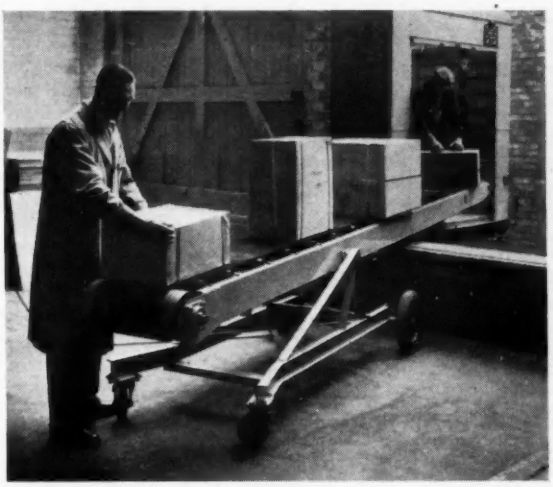
Normally a wettable material is mechanically weak, but the special plastic impregnation of the new fill imparts a high degree of wet strength without sacrificing its absorbent capacity. It also provides resistance to rotting and chemical degradation.

Thermotank cooling towers are being made 12 graduated sizes, the largest of which will have a capacity of 90,000 gal. per hour, a diameter of 20 ft., a height of 12 ft. and weighs only 9½ tons. This unit will cool water at 87°F. to 75°F. at a wet bulb temperature of 68°F., when working at full capacity.—*Thermotank Ltd.*

Loading conveyor

A WELL-KNOWN firm of plastic manufacturers use a loading conveyor to accelerate the despatch of cartoned goods. The conveyor is of a particularly light and portable design, having solid rubber cushion-tyred wheels at one end and castors at the other, while the boom is hinged approximately at the point of discharge heights.

The loader is fitted with rough top belting and the drive is provided by means of a Thorite motorised driving drum. Pressed steel channel side frames give a clean and modern appearance.—*T. & T. Works Ltd.*



The portable conveyor in use carrying cartons to a loading bay outside.

Screw elevator

THE latest development of James Hodgkinson (Salford) Ltd. is the high speed screw elevator. It has been designed primarily for handling boiler-house smalls, where for one reason or another it is not convenient, or possible, to prepare a concrete ground hopper or pit. For feeding the hoppers of 'low ram,' chain grate or underfeed stokers under such circumstances, it is ideal.

The elevator consists of a steel tube in which rotates a worm, housed in totally-sealed, self-aligning ball bearings and driven by a constant speed, totally-enclosed motor mounted on a platform at the head of the casing. A short standard chute extends from the head, to which an additional section or breeches-piece can be added, provision being made for this to be swivelled to suit site conditions. At the tail, the worm is exposed for the entry of coal. An adjustable device enables the head to be supported from any convenient structure in the boilerhouse.

Each unit will handle up to 1½ tons of smalls per hour and feed direct to the stoker simply by resting the tail on a pile of coal and lifting the head into position over the stoker hopper. The elevator is entirely self-cleaning and no running maintenance is required, since the bearings are grease-packed and sealed for life. Costly erection expenses and delays are eliminated—the machine can be working within half an hour of delivery.

The high speed screw elevator is supplied in the following standard lengths—13 ft., 14 ft., 15 ft., 16 ft., 17 ft., and 18 ft.—*James Hodgkinson (Salford) Ltd.*

GAS JOURNAL

Readers' Enquiry Service

Details and coupons are given on the backing page

Bag filters

THE Holmes-Retroflux bag filter is particularly suitable for those applications where high dust burdens are encountered and/or dusts of an adhesive nature have to be collected. It is the continuous method of cleaning the filter bags which ensures that large volumes can be handled with constant pressure drop and high collection efficiency. An efficiency in excess of 99% for all particles, including those of sub-micron size can be guaranteed.

The dust-laden air enters the header within the casing and is distributed to the inside of the filter bags, the air and dust moving in the same direction. The tendency of the dust to settle by gravity is not impeded by air currents as the air passes through the filter bags radially, and the air velocity gradually diminishes to zero at their lowest end. The dust collected on the inner surface of the filter bags is continuously dislodged by the passage of high velocity air jets through the fabric in the reverse direction to the main air stream. The dislodged dust falls by gravity to the worm conveyor or hopper below.

The jet tubes have a narrow slot in the face which is in contact with the filter bag and are specially shaped and finished to avoid damage to the fabric. The ends of the tubes are set in hollow frames which are suspended by chains, and are supplied with high pressure air from a blower through a flexible hose. The frames operate in counter balanced pairs when large volumes of air are being filtered; each frame is capable of cleaning the complete length of up to 36 bags.

The jet tubes are mounted in pairs, one pair being positioned approximately 3 in. below and at 90° to the other so that progressive cleaning of the filter bags can be achieved efficiently and without damage to the fabric. Each jet tube is in contact with the surface of the bag over a quarter of its circumference only, and in operation the bag becomes slightly elliptical in shape as each pair of tubes travels along its length. This arrangement of the jet tubes ensures that the bag is not constrained in any way; creases do not form in the fabric and wear is reduced to such an extent that filtering media such as glass fibre can be used successfully when handling hot flue gases. The reciprocating frames carrying the reverse jet tubes travel at very slow speed and this also reduces wear and tear on the material of the filter bags.

The high velocity jet of air which passes through the fabric is measured in thousands of feet per minute compared with less than 10 ft. per minute for the normal filtering air speed through the filter bag. This high efficiency cleaning cannot be effected by some types of bag filters in which the reversal of flow of clean air during the shaking operation is at comparatively low velocity. One important result of this efficient cleaning is that the filter resistance can be maintained at approximately half of that normally experienced with a conventional bag filter without sacrificing any drop in efficiency. An appreciable saving in power consumption is therefore achieved.—*W. C. Holmes & Co. Ltd.*

Expanded neoprene

A unique feature of Rubazote is its closed-cell structure; Rubazote expanded neoprene also has these advantages. It will, in addition, resist oil and petrol. It will also withstand temperatures from −40°F. to 158°F. It has better ageing properties when exposed to natural light.

These qualities give Rubazote expanded Neoprene many important applications in industry. It is particularly suitable for seals and resilient pads in exposed situations adjacent to heat sources, or where there is a risk of contamination from oil, petrol or grease.—*Expanded Rubber Co. Ltd.*

Readers' Enquiry Service

If you would like more information on products and services mentioned in the advertisement or editorial pages of the 'Gas Journal', fill in the coupons below, *one for each enquiry*, and send in unsealed envelope to **'Readers Enquiry Service', Gas Journal, 11 Bolt Court, Fleet Street, London, E.C.4.**

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ENCOURAGEMENT FROM MINISTRY

GAS AT WORK IN INDUSTRY SHOW PRAISED: 'SOUND AND COMPETENT'

NEWS SUPPLEMENT

A SIGNIFICANT message of encouragement to the gas industry was given by Mr. J. C. George, C.B.E., M.P., the Parliamentary Secretary to the Ministry of the Power, on March 1 at the lunch which marked the opening of the second Gas at Work in Industry Exhibition in London. 'Don't look on gas as a dying industry but as a thriving industry,' he told his listeners at the Mayfair Hotel. 'Gas is only old-fashioned if it is used in an old-fashioned way.'

Mr. George said he had been 'tremendously impressed by this sound and competent attempt to extend the use of gas in industry.' Mr. Therm was a little tired of living in a kitchen apron and liked a chance to show his versatility. 'I hope that in future Mr. Therm will wear his dungarees more and leave aside his apron more than in the past.'

New techniques

The gas industry had realised quicker than most industries that the way to get the goods sold was to get them to the customers, and the appliance manufacturers had backed up the industry by devising new techniques.

Mr. George said he felt sure that there was room in industry for the greater use of gas. There were 43,000 factories in the areas of the four Boards which had organised the exhibition—the Eastern, North Thames, South Eastern and Southern. Could it be that a chance was being lost in these areas of effecting the savings made possible by the use of gas?

Modern industry, said Mr. George, was a delicate creature; the stoppage of one part of it could bring the whole thing to a halt. The fuel used must be available under all conditions. The gas industry, founded on British coal, now being reinforced with oil and gas in other forms, had the tools to do the job; it was up to those present to see that they did it.

The modern way

There were no points to get stuck in gasworks, he added, and no conductor rails to get frozen up. 'Gas is only old-fashioned if it is used in an old-fashioned way. The boards and the makers have made sure that it can be used in a modern way.'

Gas markets were being attacked, but the seductiveness of oil had not depressed the industry and the boards were the centres of vigorous achievement. Gas had sought and found new allies, exhibited vigour and virility and had shown that it was determined to live, expand and prosper.

For 150 years the industry had worked in happy harmony with coal and the major aim was to continue that association. The Gas Council had gone a long way towards producing the hydrogenation of cheap coals, but until that was fully accomplished the industry must conduct a holding operation. The importation of liquid methane, regarded so suspiciously by the miner, was a saviour and not an assassin.

Mr. George concluded with an exhortation to industrial fuel users: 'Gas is a most satisfactory fuel,' he said. 'Don't look on it as a dying, but a thriving industry.'

He was replying to the toast of 'The Guests' proposed by Mr. W. K. Hutchison, C.B.E., Deputy Chairman of the Gas Council.

During the morning Mr. George had inspected the exhibition. The Minister himself, Mr. Richard Wood, paid it a visit on March 3. The exhibition remains open at the Horticultural Hall until March 12.

The Minister of Power, Mr. Richard Wood, asks questions, at the Gas at Work in Industry Exhibition, of Mr. H. E. King, Eastern Gas Board. Also in the picture are Mr. W. A. Lloyd-Dodd, Industrial Gas Officer, S.G.B., and Mr. A. E. Tyrrell, Deputy Divisional Manager, H.Q. Division, N.T.G.B.

'Robots' help clear coke stocks

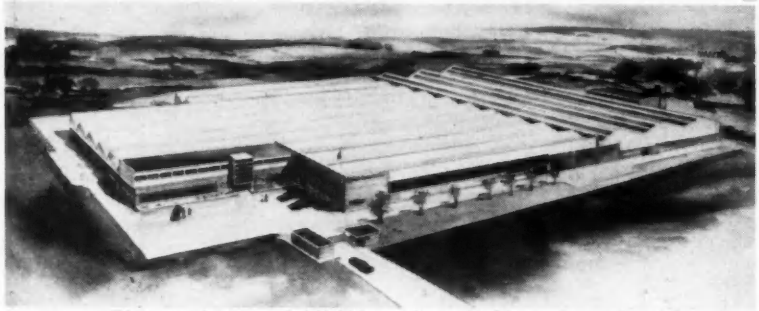
ORDERS for coke can now be phoned to the Birmingham divisional office of the West Midlands Gas Board at any time of the day or night, including weekends.

When the office is closed, a call to a special number—Central 2242—brings one of two 'robot' answering machines into operation.

The caller is told he is listening to a machine and asked to give his name, address and order. The information is automatically tape recorded and played back by the office staff.

Although West Midlands Board coke stocks still exceed 316,000 tons, they have been reduced by 39,000 tons since the beginning of the winter. Surveys of several recently-created smoke control areas in the Black Country have shown that housewives, at first critical of coke, have been quite satisfied after being shown how to use it on proper appliances.

G. & M. shuffles production



The new factory of 160,000 sq. ft. at Padiham, Lancashire.

THE production of gas meter components hitherto undertaken by Thomas Glover & Company at Edmonton has been moved into the three factories of Meters Ltd. in the Oldham and Manchester districts. A new centralised administrative and research building is being planned on the Oldham site. At the end of the current year this will house the executive and development staffs of the two companies which are now spread out in Manchester, Oldham and Edmonton.

Merge this year

The meter assembly shop at Edmonton will remain to serve boards in the south. Certain distinctive features of the two companies' products—such as the respective prepayment mechanisms—will be retained until new developments are evolved. To facilitate co-ordination, Mr. G. Barlow has already been appointed Managing Director of both concerns. Administratively the two companies will merge this year.

Over to fridges

Thomas Glover's factory at Edmonton has been handed over to R. & A. Main who are transferring into it their refrigerator production. Mechanised equipment, comprising automatic painting plant, unit manufacture and cabinet assembly, is now being installed. Later this year the factory should be in full production, working in conjunction with the Edmonton cooker factory of the same company.

Preliminary steps are being taken to amalgamate the production of the two companies within the group that manufacture equipment involving the heating of water by gas. Main Water Heaters Ltd and Morley Products (Padiham) Ltd. will join together in a new unit to be located at Padiham where a factory area of some 160,000 sq. ft. has already been erected on a site of 30 acres.

Mr. W. K. Tate, previously Managing Director of Thomas Glover, will become Managing Director of the new joint company.

SOVIET GAS OUTPUT 125% UP ON 1958

ACCORDING to the report of the Central Statistical Board of the U.S.S.R. Council of Ministers on the results of the fulfilment of the state plan for economic development in 1959, gas output totalled 37,200 mill. cu. metres or 125% of the 1958 output.

Compared with 1958, state capital investments in the oil and gas industry increased by 14%, and new gas pipelines stretching for 3,700 kilometres and oil and oil-product pipe-lines with a total length of over 2,000 kilometres were put into service.

Labour productivity in the oil extracting industry increased by 12%.

EXPRESSION OF GRATITUDE

Mr. W. K. Hutchison, former chairman of the South Eastern Gas Board, now Deputy Chairman of the Gas Council, pictured at a ceremony in which about 200 people—Board members, chief officers and representatives of senior officers, staff and manual workers—saw him receive a portrait of himself from the Deputy Chairman, S.E.G.B., Mr. R. H. Sandford Smith, who made the presentation on behalf of the Board's employees. Mr. R. N. Bruce, Chairman of the Board, referred to Mr. Hutchison's work in reorganising about 60 undertakings into 'an efficient unified and living organisation.' From left: Mr. Sandford Smith, Mr. Hutchison, and Mr. Bruce.

Committee warn: borings, but not buildings

GAS Council plans to locate an impervious strata in the lower green sands in the Winchester area into which gas could be pumped and stored could be frustrated unless the Council can obtain the permission of Hants county planning committee.

Reporting on this, the committee states: 'We do not object to borings in places where the local amenities would not be affected, but the Gas Council have not so far disclosed their intentions should any of the borings prove successful.

'It appears that considerable installations of plant, machinery and buildings might be involved and it has, therefore, been made clear to the Gas Council that the grant of planning permission for the making of trial borings is entirely without prejudice to the subsequent consideration by the local planning authority of any proposals for the erection of buildings or the installation of plant and machinery in connection with the underground storage of gas.'

Island company beats high costs

DESPITE costs rising very considerably the price of gas had not been increased since April, 1956, said Mr. W. S. Waid, Chairman of the Douglas Gas Light Company, Isle of Man, at the annual meeting of shareholders

Sales of gas and residual products during 1959 showed a decrease of £6,771 at £166,813. As the coal was of a rather higher quality less was used to produce gas, although as a result they had less coke for disposal. There had been an increase in sales of appliances. A balance of £8,263 remained to carry forward to next year's accounts, or £302 less than a year ago. That, Mr. Waid said, was of little significance, particularly taking into account provision for renewals and special purposes funds.

Mr. Waid tendered the thanks of the company to Mr. A. R. Bisset, Engineer and Manager, and Mr. A. H. Boyd, Secretary, and their staffs. The meeting approved a final dividend of 9.8d. per share, and agreed to increase directors' fees by £250 to £1,250. There are five directors.

13 votes for freedom

The Town Council of Irvine (Ayrshire) has decided that tenants of old houses which are being improved by the Council are to be allowed to say whether they want a gas or an electric cooker installed. The Council turned down—by 13 votes to three—a recommendation of the housing committee that only electric cookers should be installed.

PERSONAL NOTES

MISS B. HOLM has been appointed by the West Midlands Gas Board as an adviser on large scale catering equipment. Trained at Leicester Domestic Science Training College, Miss Holm gained practical experience in cooking and in the working of gas catering appliances at Birmingham University, at Saltley Training College and with the Worcestershire Education Committee.

MR. A. J. INGRAM, who has for some time been area diesel engineer for the South Western Gas Board at Plymouth and who was previously on the staff of the West Midlands Gas Board at Redditch, has been appointed to a post on the outside sales advisory staff of the engineering firm of Blackstone & Co. Ltd., of Dursley, Glos., and of Ryhall Road, Stamford, Lincs.

MR. G. S. G. BLUNT has joined the technical sales staff of the process control division of Bailey Meters & Controls Ltd.

COMING EVENTS

March 1-12.—'GAS AT WORK IN INDUSTRY': Exhibition at the Royal Horticultural Hall, London, S.W.1, sponsored by the Eastern, North Thames, South Eastern and Southern Gas Boards.

March 11.—COKE OVEN MANAGERS' ASSOCIATION, SOUTHERN SECTION: Park Hotel, Park Place, Cardiff. The Coal Seams of South Wales,' by H. F. Adams, N.C.B. Coal Survey Laboratory, Cardiff.

March 12.—MANCHESTER JUNIORS: Lancashire Cricket Club Pavilion, Old Trafford, Manchester. Annual Dinner and Dance.

March 12.—YORKSHIRE JUNIORS: Harrogate. 'Internal Organisation' by C. Roberts, Sales and Service Officer, Wakefield.

March 15.—LONDON AND SOUTHERN SECTION, I.G.E.: Pepys House, 14, Rochester Row, Westminster, S.W.1. 'The Production of Domestic Coke,' by G. H. Fuidge, of the South Eastern Gas Board.

March 16.—SOUTH WESTERN SECTION, I.G.E., Exeter. 'The Use of Diesel Engines in the Gas Industry,' by A. J. Ingram, Area Diesel Engineer, South Western Gas Board. To be preceded by a visit to Exeter manufacturing station.

March 16.—EASTERN SECTION I.G.E., Bedford. Morning visit to Bedford Gasworks. Luncheon by invitation of the Eastern Gas Board. Afternoon: Paper on 'The Bedford Oil Gas Plant,' by K. B. Meggitt.

March 16.—SOUTH WESTERN G.C.C.: Taunton. Council meeting at 11 a.m.

TRIALS NEAR COMPLETION

THE Methane Pioneer, the prototype tanker owned jointly by the Gas Council and Constock International Methane Ltd. of America which has been carrying methane in liquid form from the United States to the North Thames Gas Board's marine terminal at Canvey, will make the final delivery during this month in the series of seven trial voyages undertaken in connection with the development of the transportation of liquefied natural gases.

During the trial over 12,000 tons of methane will have been delivered and converted by the North Thames Gas Board to town gas.

With the successful completion of the trial stage of the developments the ship is to be laid up in a British port pending a decision on her possible assignment to other service.

The trials have provided valuable information for the consideration of possible large ship operations.

FITTING REWARDS

Three Southern Gas Board apprentice gas fitters were among students who received awards when the Department of Building of the Southampton Technical College held their annual prize giving at Southampton recently. William Griffiths, Peter Bristow and Eric Cole won their prizes, presented by Abbott Birks & Co. Ltd., in competition with about 30 colleagues.

More space on Ideal Home stand

Fewer appliances, more space and a particular emphasis on house heating are features of the Gas Council's stand at the Ideal Home Exhibition this year. Our photograph shows part of the display devoted to small bore central heating. Other sections of the house heating exhibit deal with warm air heaters, hot water supplies, etc.

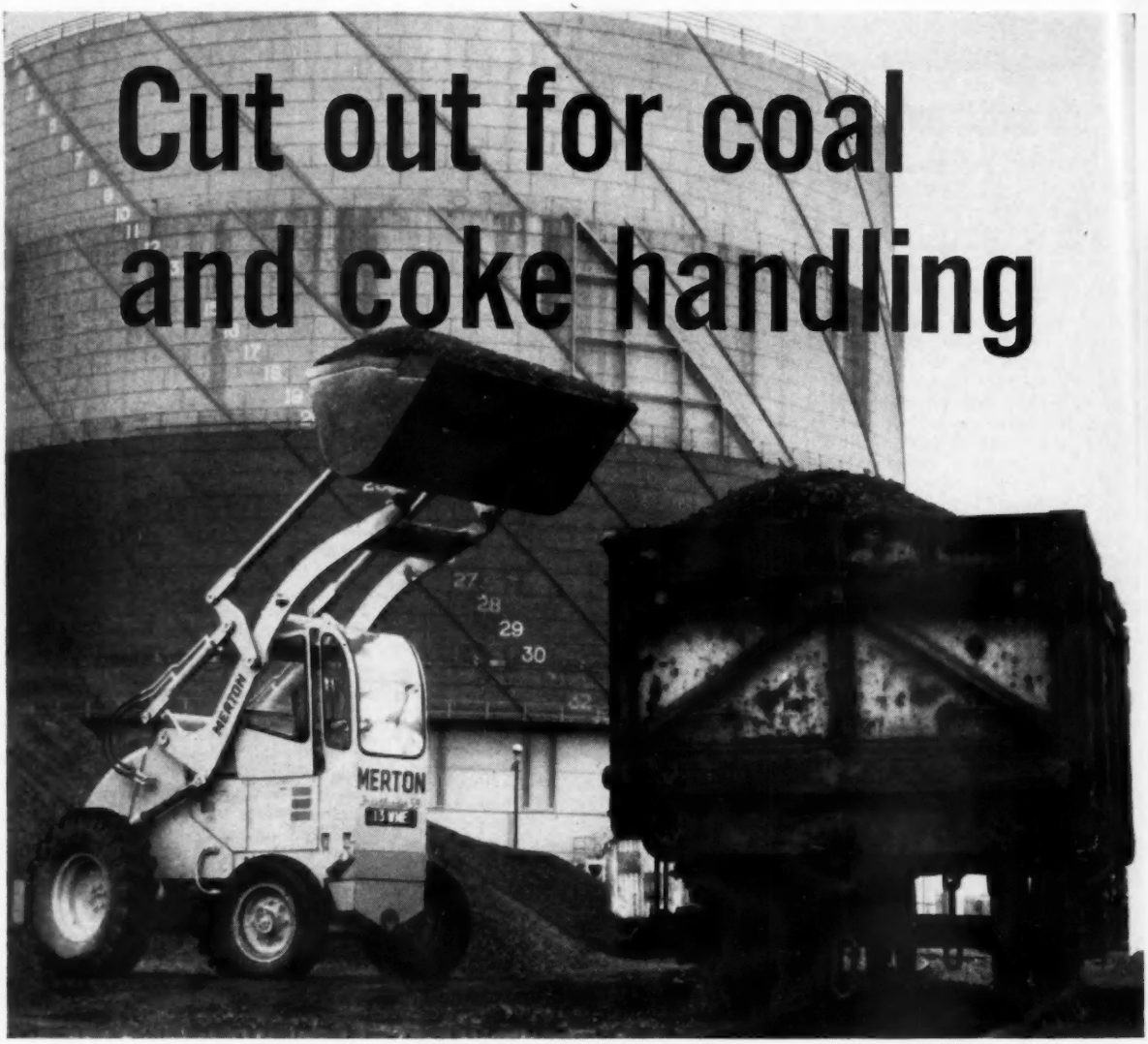
OBITUARY

MR. T. W. SIMPSON, who was production engineer of the North Western Gas Board, has died in his 56th year. Mr. Simpson began his career with the Woodall-Duckham Company in London. Then, after a year or so with a small firm of carbonising plant engineers in Leeds, he joined the U.K. Gas Corporation, the largest gas holding company in the country, under the late Colonel W. Moncrieff Carr. With U.K. Gas he was responsible, not only for the repairs and resetting of the carbonising plant at all its 76 constituent companies scattered throughout England, Scotland and Wales, but also for the construction of all new plant from the foundations upward. In the course of his work with U.K. Gas he built up one of the most effective mobile construction teams the gas industry has known. On nationalisation of the industry, Mr. Simpson was appointed Board construction and maintenance engineer. Later he succeeded to the post of production engineer. He leaves a widow and one son.

A colleague writes:

A Londoner by birth, Mr. Simpson spent the last 22 years of his life in the North West, which he came to love. During those years he carved for himself a special niche in the affections of his colleagues with his unfailing cheerfulness, sincerity and steadfastness. Anything he undertook to do he did without fail. He was always ready to lend a helping hand to those in need of it, and in his dealings with others always imputed the best motives to what they said or did. He was never heard to say an unkind word about anybody. Of Tom Simpson it can be said that he was the soul of courtesy, kindness and gentleness, while maintaining in all that he did firm principles and great steadfastness of character. His passing is indeed a sad event. He will be missed both as an admired colleague, and as a friend of rare quality.

Cut out for coal and coke handling



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